Supplementary File S3

Fixed-field Geometry for Craniospinal Irradiation

The fixed-field geometry for craniospinal irradiation entails the use of asymmetric half-beam blocked multileaf collimeter (MLC)-shaped bilateral cranial fields matched geometrically with the divergence of the direct posterior spinal field using a fixed collimator rotation. The set-up isocentre for fixed-field geometry is the mid-body of C2 vertebra. The lower border of the cranial field is half-beam blocked field at this level (mid-body C2-vertebra), while all other borders (upper anterior, and posterior) flash in air. The width of the cranial fields is covered using asymmetric X-jaws. Since the lower border of the cranial field is half-beam blocked (Y1 = 0), the beam at this central axis is non-divergent eliminating the need for any couch rotation. Only collimator rotation of the cranial field is required to match with the divergence of the exiting posterior spinal field. A reference point is inserted at the geometric isocentre of the brain in the midline for dose calculation and normalization. Following the placement of cranial fields including MLC-shielding of the orofacial region, the couch is moved longitudinally by a fixed distance of 20 cm to arrive at the spinal isocentre and the gantry rotated posteriorly (G = 180). Although theoretically, one could place the upper border of the posterior spinal field in close proximity to the lower border of the cranial field, it is generally recommended to keep a small gap (3-5 mm) at the craniospinal junction to prevent any overlap due to random errors. To facilitate that, the upper jaw of the posterior spinal field is opened nearly fully (Y2 = 19.7 or 19.5 cm) to keep a 3-5 mm gap at the craniospinal junction just like in conventional fluoroscopic planning, while the lower jaw (Y1) is opened appropriately (Y1 = 14-20 cm) depending upon the spinal length to cover the lower most extent of the spinal planning target volume (PTV) adequately. The width of the posterior spinal field is decided based on the beam's eye view of the spinal PTV at the lumbar level (generally the widest part of the target). Once again, a reference point is inserted at the level of the spinal isocentre at a depth (typically 5-6 cm) for dose calculation and normalization. The option of using MLCs for shaping the spinal PTV is left to the discretion of the treating physician. In case of older children and/or adults (where the spinal length cannot be encompassed by a single posterior spinal field, two adjacent spinal fields can be used. The upper spinal field is placed in the same way as described before. For the lower spinal field, the couch is moved further longitudinally from the upper spinal isocentre by a fixed distance (generally 25 cm in older children, but occasionally 30 cm in adults) to arrive at the isocentre of the lower spinal field. The upper jaw (Y2) of the lower spinal field is opened so that the beams overlap beyond the thecal sac (typically posterior third of the vertebral body). The lower jaw(Y1) of the lower spinal field is opened depending upon the lower most extent of the spinal PTV. A third reference point is inserted at the level of the lower spinal isocentre at an appropriate depth (typically 5-6 cm) for dose calculation and normalization. It is recommended that all junctions (whether craniospinal or spinal-spinal) be periodically feathered throughout the course of irradiation to reduce dose inhomogeneity across them by shifting them in one direction (generally inferiorly by 0.5-1.0 cm). Composite dose distribution of the entire craniospinal irradiation can be viewed in axial, coronal, and sagittal sections by summation of all the cranial and spinal plans created with periodic junction shifts. Verification of supine craniospinal irradiation (CSI) should be based on verification CT-scans acquired periodically on the treating linear accelerator.